

From T. rex to asteroid impact: Early studies (1901–1980) of the Hell Creek Formation in its type area.

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Table DR1a. White's (1883) "Tabular View" of continental mollusks of North America was published at a time when heroic-sized publications on these fossils was almost common (e.g., Meek, 1876). White wrote more on the relationships of species over a broader area of North America than any other paleontologist of his day. His effort on this subject is concomitant with his publication of many new species assigned to the Laramie age or period. These assignments required decades of deconstruction in the form of field work, geologic mapping, and the study of land mammals to properly chronostratigraphically arrange continental strata. A process that remains ongoing.

Table DR1b. Names of taxa used in White's (1883) "Tabular View of the Non-marine Fossil Mollusca of North America."

Table DR2. Whitfield (1903, 1907) named a number of new species that he specifically compared to modern unionids to indicate the likely origin of today's North American interior fauna (Mississippi-Ohio-Missouri drainage system). This comparison was so indicated, in part, by using modern taxa as root words to his new species names. Pilsbry (1904) was quick to point out that the morphology of some of the Hell Creek Formation species indicated hyriid (Hyriidae)

affinities (non-North American).

Pilsbry, H.A., 1904, Notice of six new species of *Unios* from the Laramie Group: *Nautilus*, v. 18, p. 12.

Table DR3. The North American record of continental mollusks is vast and significantly underused. A simple faunal comparison can be made between the Lance Formation in the Powder River Basin (Wyoming) and the Hell Creek Formation in the Williston Basin (Montana). Both faunas are interpreted as Lancian (NALMA) and derived from relatively small geographic areas in relatively thin sections. Until present studies neither section had been substantially recollected for mollusks, but both faunas indicate considerable diversity based on limited early work (Stanton and Knowlton, 1897; Hartman, 1998; and Hartman museum observations; Russell, 1976). Although similar faunal elements exist at both locations, interesting differences exist in the unionoid population.

Table DR4. Russell (1964, 1976) was a major contributor to North American continental molluscan paleontology. He (1964) worried about temporal correlation of molluscan faunas in a manner similar to that undertaken by Wood et al. (1940) for mammals. Although fossil “ages” not tied directly to strata (biostratigraphy) are ultimately limiting, Russell attempted to extend White’s efforts in a way not attempted by other continental molluscan paleontologists.

TABLE DR 1a. WHITE'S BIOCHRONOLOGY OF CONTINENTAL FOSSIL MOLLUSKS AS OF 1883*

Geologic Time		"Tabular View of the Non-Marine Fossil Mollusca of North America"											
Recent	R												
Quaternary	Q												
Pliocene	P												
Miocene	M												
Eocene	E												
Laramie	L	L	L	L	L	L	L	L	L	L	L	L	L
Cretaceous	K	K											
Jurassic	J							J	J				
Triassic	T							?	?				
Carboniferous	C							C	C				
Devonian	D							DD	DD				
Age-Taxon#	#												
* See DR 1b for taxon names corresponding to Taxon#s.													
"Ages" after White are abbreviated as follows:													
R, Rec, Recent													
Q, Qua, Quat.													
P, Pli, Pliocene													
M, Mio, Miocene													
E, Eoc, Eocene													
L, Lar, Laramie													
K, Cre, Cret.													
J, Jur, Jurassic													
T, Tri, Triassic													
C, Car, Carbon.													
D, Dev, Devon.													
Age-Taxon#	#												
The total number of taxa has been summed for each age (as of 1883).													
R													
Q													
P													
M													
N													
E													
L													
K													
J													
T													
C													
D													
Age-Taxon#	#												
# of Taxa													
R													
Q													
P													
M													
E													
L													
K													
J													
T													
C													
D													
Age-Taxon#	#												
0													
0													
1													
34													
12													
141													
J													
7													
3													
9													
3													

"Ages" after
White are
abbreviated as
follows:
R, Rec, Recent
Q, Qua, Quat.
P, Pli, Pliocene
M, Mio, Miocene
E, Eoc, Eocene
L, Lar, Laramie
K, Cre, Cret.
J, Jur, Jurassic
T, Tri, Triassic
C, Car, Carbon.
D, Dev, Devon.

The total number
of taxa has been
summed for each
age (as of 1883).

TABLE DR1b. TAXON NAMES USED IN WHITE'S (1883) "TABULAR VIEW OF THE
NON-MARINE FOSSIL MOLLUSCA OF NORTH AMERICA" *

Age-Taxon		Age-Taxon	
Code †	Taxon (as per White, 1883) §	Code †	Taxon (as per White, 1883) §
6-Lar-T001	Ostrea subtrigonalis E. & S.	6-Lar-T054	C. occidentalis M. & H.
6-Lar-T 002	O. glabra M. & H.	6-Lar-T055	O. bannisteri M.
6-Lar-T 003	O. w yom ingensis M eek	6-Lar-T056	C. cytheriformis M. & H.
6-Lar-T 004	O. arcuatus M eek	6-Lar-T057	C. nebrascensis M. & H.
6-Lar-T 005	O. insecuta W.	6-Lar-T058	C. (Leptesthes) fracta M. & H.
5-C re-T 006	A nom ia propatoris W.	6-Lar-T059	C. (L.) subelliptica M. & H.
6-Lar-T 007	A. m icronem a M.	6-Lar-T060	C. (L.) macropistha W.
6-Lar-T 008	A. gryphorhynchus M.	6-Lar-T061	C. (L.) planumbona M.
6-Lar-T 009	V olsella (B rachydontes) regularis W.	6-Lar-T062	C. umbonella M.
6-Lar-T 010	V. (B.) laticostata W.	6-Lar-T063	C. augheyi W.
1-Dev-T011	Anodontia? catskillensis (Vanuxem) Hall	6-Lar-T064	C. berthoudi W.
1-Dev-T012	Anodontia? Angustata (Vanuxem) Hall	6-Lar-T065	C. cleburni W.
6-Lar-T013	A. propatoris W.	6-Lar-T066	C. obesa W.
6-Lar-T014	A. parallela W.	6-Lar-T067	C. cardiniaeformis W.
2-C ar-T 015	N aiadites carbonaria Dawson	6-Lar-T068	Sphaerium planum M. & H.
2-C ar-T 016	N. elongata Dawson	6-Lar-T069	S. recticardinale M. & H.
2-C ar-T 017	N. laevis Dawson	6-Lar-T070	S. formosum M. & H.
5-C re-T 018	Margaritana nebrascensis M. & H.	6-Lar-T071	S. subellipticum M. & H.
3-T ri-T 019?	U nio cristonensis M.	7-Eoc-T072	S. rugosum M.
3-T ri-T 020?	U. gallinensis M.	7-Eoc-T073	S. ? idahoensis M.
3-T ri-T 021?	U. terrae-rubrae M	6-Lar-T074	Pisidium saginatum W.
4-Juri-T 022	U. nucalis M. & H.	6-Lar-T075	Corbula pyriformis M.
4-Juri-T 023	U. stew ardi W.	6-Lar-T076	C. englemani M.
5-C re-T 024	U. (Margaritana ?) hubbardi Gabb	6-Lar-T077	C. undifera M.
5-C re-T 025	U. penultim us Gabb	6-Lar-T 078	C. undifera, var. subundifera W.
6-Lar-T 026	U. belliplicatus M	6-Lar-T 079	C orbula subtrigonalis M. & H.
6-Lar-T 027	U. vetustus M.	6-Lar-T 080	C. perundata M. & H.
6-Lar-T 028	U. subspatulatus M .& H	6-Lar-T 081	C. crassatelliform is M.
6-Lar-T 029	U. danae M. & H.	6-Lar-T 082	C. tropidophora M.
6-Lar-T 030	U. dew eyanus M. & H.	6-Lar-T 083	C. m acrtriform is M. & H.
6-Lar-T 031	U. cryptorhynchus W	5-C re-T 084	M elam pus ? antiquus M.
6-Lar-T 032	U. senectus W.	6-Lar-T 085	R hytophorus priscus M.
6-Lar-T 033	U. primaevus W.	6-Lar-T 086	R. m eekii W.
6-Lar-T034	U. priscus M. & H.	6-Lar-T 087	Lim naea (Lim nophysa) nitidula M.
6-Lar-T035	U. couesii W.	6-Lar-T 088	L. (Acella) haldem ani W.
6-Lar-T036	U. endlichii W.	6-Lar-T 089	L. (Pleurolim naea) tenuicostata M.
6-Lar-T037	U. propheticus White.	7-E oc-T 090	L. vetusta M.
6-Lar-T038	U. brachyopisthus W.	7-E oc-T 091	L. similis M.
6-Lar-T039	U. proavitus W.	7-E oc-T 092	L. (Leptolim nea) m inuscula W.
6-Lar-T040	U. aldrichi W.	8-M io-T 093	L. meeki E. & S.
6-Lar-T041	U. goniambonatus W.	8-M io-T 094	L. shumardi M.
6-Lar-T042	U. holmesianus W.	9-P li-T 095?	L. (Polyrhytia) kingii M.
6-Lar-T043	U. gonionotus W.	4-Jur-T 096	P lanorbis veteranus M. & H.
6-Lar-T044	U. mendax W.	6-Lar-T 097	P. convolutus M. & H.
7-Eoc-T045	U. clinopisthus W	6-Lar-T 098	P. (B. athyom phalus) am plexus M. & H.
7-Eoc-T046	U. meekii W.	6-Lar-T099	P. (B.) planoconvexus M. & H.
7-Eoc-T047	U. shoshonensis W.	6-Lar-T100	P. (B.) kanabensis W.
7-Eoc-T048	U. washakensis M.	6-Lar-T101	P. (Gyraulus) militaris W.
7-Eoc-T049	U. haydeni M.	7-Eoc-T102	P. utahensis M.
7-Eoc-T050	U. tellinoides Hall	7-Eoc-T103	P. spectabilis M.
5-Cre-T051	Cyrena dakotensis M. & H.	7-Eoc-T104	P. cirratus W.
5-Cre-T052	C. carletoni M.	7-Eoc-T105	P. aequalis W.
6-Lar-T053	Corbicula (Veloritina) durkeei M.	8-Mio-T106	P. vetustus M. & H.

8-Mio-T107	<i>P. nebrascensis</i> E. & S.	8-Mio-T168	<i>M. ? sculptilis</i> M.
8-Mio-T108	<i>P. leidyi</i> M. & H.	8-Mio-T169	<i>M. ? subsculptilis</i> M
8-Mio-T109?	<i>P. lunatus</i> Conrad	8-Mio-T170	<i>M. ? taylori</i> Gahb
8-Mio-T110	<i>Carinifex (Vorticifex) tryoni</i> M.	6-Lar-T171	<i>Pyrgulifera humerosa</i> M.
8-Mio-T111	<i>C. (V.) binneyi</i> M.	6-Lar-T172	<i>Melanopsis ? americana</i> W.
5-Cre-T112	<i>Physa carletoni</i> M.	6-Lar-T173	<i>Goniobasis cleburni</i> W
6-Lar-T113	<i>P. copei</i> W.	6-Lar-T174	<i>G. chrysallis</i> M.
6-Lar-T114	<i>P. felix</i> W.	6-Lar-T175	<i>G. chrysalloidea</i> W
7-Eoc-T115	<i>P. pleromatis</i> W.	6-Lar-T176	<i>G. macilenta</i> W.
7-Eoc-T116	<i>P. bridgerensis</i> M.	6-Lar-T177	<i>G. (Lioplax ?) endlichi</i> W.
8-Mio-T117	<i>P. secalina</i> E. & S.	6-Lar-T178	<i>G. convexa</i> M. & H.
6-Lar-T118	<i>Bulinus atavus</i> W	6-Lar-T179	<i>G. invenusta</i> M. & H.
6-Lar-T119	<i>B. subelongatus</i> M. & H.	6-Lar-T180	<i>G. sublaevis</i> M. & H.
6-Lar-T120	<i>B. longinusculus</i> M. & H.	6-Lar-T181	<i>G. omitta</i> M. & H.
6-Lar-T121	<i>B. rhomboideus</i> M. & H.	6-Lar-T182	<i>G. ? subtortosa</i> M. & H.
6-Lar-T122	<i>B. disjunctus</i> W.	6-Lar-T183	<i>G. gracilenta</i> M.
6-Lar-T123	<i>B. kanabensis</i> W.	6-Lar-T184	<i>G. (Lioplax ?) nebrascensis</i> M. & H.
6-Lar-T124	<i>Acroloxus minutus</i> M. & H.	6-Lar-T185	<i>G. (Lioplax ?) tenuicarinata</i> M. & H.
8-Mio-T125	<i>Ancylus undulatus</i> M.	7-Eoc-T186	<i>G. tenera</i> Hall
8-Mio-T126	<i>Latia dallii</i> W.	7-Eoc-T187	<i>G. nodulifera</i> M.
2-Car-T127	<i>Zonites priscus</i> Dawson	7-Eoc-T188	<i>G. simpsoni</i> M.
8-Mio-T128?	<i>Z. marginicola</i> Conrad	7-Eoc-T189	<i>G. carteri</i> Conrad
6-Lar-T129	<i>Vitrina ? obliqua</i> M. & H.	8-Mio-T190	<i>Lithasia antiqua</i> Gabb
6-Lar-T130	<i>Hyalina ? occidentalis</i> M. & H.	6-Lar-T191	<i>Cassiopella turricula</i> W.
6-Lar-T131	<i>H. ? evansi</i> M. & H.	6-Lar-T192	<i>Hydrobia subconica</i> M.
7-Eoc-T132	<i>Macrocyclis spatiosa</i> M. & H.	6-Lar-T193	<i>H. anthonyi</i> M. & H.
2-Car-T133	<i>Dawsonella meekii</i> Bradley	6-Lar-T194	<i>H. eulimoides</i> M.
6-Lar-T134	<i>Helix vetusta</i> M. & H.	6-Lar-T195	<i>H. warrenana</i> M. & H.
6-Lar-T135	<i>H. (Strobila ?) kanabensis</i> W.	6-Lar-T196	<i>H. recta</i> W.
6-Lar-T136	<i>H. (Patula ?) sepulta</i> W.	6-Lar-T 197	<i>H. utahensis</i> W.
6-Lar-T137	<i>H. (Triodopsis ?) evanstonensis</i> W.	6-Lar-T 198	<i>M icropyrgus m inutulus</i> M . & H .
7-Eoc-T138	<i>H. (Aглаia ?) peripheria</i> W .	7-E oc-T 199	<i>B ythinella gregaria</i> M .
7-E oc-T 139	<i>H . (A rianta ?) riparia</i> W .	4-Jur-T 200	<i>V iviparus gillianus</i> M . & H .
8-M io-T 140	<i>H . (A . ?) leidyi</i> H all & M eek	4-Jur-T 201	<i>I.ioplacodes veterans</i> M . & H .
7-E oc-T 141	<i>H . ? veterna</i> M . & H .	6-Lar-T 202	<i>V iviparus couesi</i> W .
6-Lar-T 142	<i>Thaum astus lim naeform is</i> M . & H .	6-Lar-T 203	<i>V . conradi</i> M . & H .
7-E oc-T 143	<i>B ulim us floridanus</i> C onrad	6-Lar-T 204	<i>V . peculiaris</i> M . & H .
6-Lar-T 144	<i>C olumna teres</i> M . & H .	6-Lar-T 205	<i>V . trochiform is</i> M . & H .
6-Lar-T 145	<i>C . vermicula</i> M . & H .	6-Lar-T 206	<i>V . leidyi</i> M . & H .
1-D ev-T 146	<i>Strophites grandaeva</i> Dawson	6-Lar-T 207	<i>V . leidyi</i> var. <i>form osus</i> M . & H .
2-C ar-T 147	<i>Pupa vetusta</i> Dawson	6-Lar-T 208	<i>V . leai</i> M . & H .
2-C ar-T 148	<i>P . bigsbyi</i> Dawson	6-Lar-T209	<i>V. reynoldsianus</i> M. & H.
2-C ar-T 149	<i>P . verm illionensis</i> Bradley	6-Lar-T210	<i>V. retusus</i> M. & H.
2-C ar-T 150	<i>Anthracopupa ohioensis</i> Whitfield	6-Lar-T211	<i>V. prudentius</i> W.
7-E oc-T 151	<i>P . (Leucocheila ?) incolata</i> W .	6-Lar-T212	<i>V. plicapressus</i> W
7-E oc-T 152	<i>P . (P upilla ?) arenula</i> W .	6-Lar-T213	<i>V. panguitchensis</i> W.
7-E oc-T 153	<i>P . (P . ?) atavuncula</i> W .	6-Lar-T214	<i>V. ionicus</i> W.
7-E oc-T 154	<i>Succinea (Brachyspira) papillispira</i> W	7-Eoc-T215	<i>V. paludinaeformis</i> Hall
.	.	7-Eoc-T216	<i>V. wyomingensis</i> M.
4-Jur-T 155	<i>N eritina nebrascensis</i> M . & H .	6-Lar-T217	<i>Tulotoma thompsoni</i> W.
6-Lar-T 156	<i>N . naticiform is</i> W .	6-Lar-T218	<i>Campeloma macrospira</i> M.
6-Lar-T 157	<i>N . volvilineata</i> W .	6-Lar-T219	<i>C. vetula</i> M. & H.
6-Lar-T 158	<i>N . bruneri</i> W .	6-Lar-T220	<i>C. multistriata</i> M. & H.
5-C re-T 159	<i>N . bannisteri</i> M cek	6-Lar-T221	<i>C. multilineata</i> M. & H.
5-C re-T 160	<i>N . (V elatella) bellatula</i> M .	6-Lar-T222	<i>C. (Lioplax ?) producta</i> W.
5-C re-T 161	<i>N . (V .) carditoidea</i> M .	4-Jur-T223	<i>Valvata scabrida</i> M. & H
6-Lar-T 162	<i>N . (V .) baptista</i> W .	5-Cre-T224	<i>V. nana</i> M.
6-Lar-T 163	<i>C erithidea nebrascensis</i> M . & H .	6-Lar-T225	<i>V. montanaensis</i> M.
6-Lar-T 164	<i>M elania wyom ingensis</i> M .	6-Lar-T226	<i>V. subumbilicata</i> M. & H.
7-E oc-T 165	<i>M . clairbornensis</i> Heilprin	6-Lar-T227	<i>V. parvula</i> M. & H.
6-Lar-T166	<i>M. larunda</i> W.		
6-Lar-T167	<i>M. ? insculpta</i> M.		

- * Table 5b abbreviations and numbers correspond to those found in Table 5a—White's biochronology of continental fossil mollusks as of 1883.
- † Age-Taxon# Code corresponds to White's (1883, p. 472–477) assignment of a given taxon to a particular “age.” The number (1, 2, 3 . . .) was used to code the Paleozoic, Mesozoic, and Paleogene time units. The taxon numbers were assigned in order of White's tabular presentation across six pages. The time intervals given by White are not of equal rank. Their abbreviations are given in Table 5a.
- § The taxon author abbreviations are of White were traditional of his time and equate to the following names: E. & S. = Evans and Shumard, M. & H. = Meek and Hayden, W. = White.

TABLE DR2. WHITFIELD'S MORPHOLOGICAL COMPARISON OF HELL CREEK FORMATION TAXA TO MODERN MUSSELS*

Whitfield's Hell Creek Taxon	Comment	Whitfield's Referenced Modern Taxon
<i>Unio aesopiformis</i> , 1903	resembles	<i>U. aesopus</i> Green
<i>Unio browni</i> , 1903	(to <i>Unio barnumi</i> Pilsbry), resembles	<i>U. securis</i> Lea and fossil taxon <i>Unio holmesiana</i> White
<i>Unio corbiculoides</i> , 1907	no comparison made	na
<i>Unio cylindricoides</i> , 1907	resembles	<i>U. cylindricus</i> Say
<i>Unio gibbosoides</i> , 1907	resembles	<i>U. gibbosus</i> Barnes and fossil taxon <i>Unio danae</i> Meek and Hayden
<i>Unio letsoni</i> , 1907	resembles	<i>U. cornutus</i> Barnes
<i>Unio percorrugata</i> , 1903	no comparison made	na
<i>Unio postbiplicata</i> , 1903	no comparison made	na
<i>Unio pyramidatoides</i> , 1907	resembles	<i>U. pyramidatus</i> Lea
<i>Unio pyramidellus</i> , 1907	no comparison made	na
<i>Unio retusoides</i> , 1903	resembles	<i>U. retusa</i> Larmarck (not <i>retusus</i> , 1907)
<i>Unio subtrigonalis</i> , 1907	exceedingly like	<i>Corbicula subtrigonalis</i> White, externally†
<i>Unio verruosiformis</i> , 1903	resembles	<i>U. verrucosus</i> Barnes

* Source of identifications and comparisons (Whitfield, 1903, 1907; Pilsbry, 1921).

"Resembles" from Whitfield (1907).

† Comparison made to external shape only.

TABLE DR3. CONTINENTAL MOLLUSK IDENTIFICATIONS FROM THE TYPE LANCIAN LANCE FORMATION (STANTON*) AND LANCIAN HELL CREEK FORMATION (RUSSELL*).

Type Lancian (= Ceratops beds), Lancian taxa (Stanton and Knowlton, 1897)	Hell Creek Formation, Lancian taxa (Russell, 1976)
<i>Corbicula</i> sp. [unknown affinity] †	<i>Corbicula</i> cf. <i>C. subelliptica</i> (Meek and Hayden)
<i>Anodonta parallela</i> White	[“ <i>Anodonta</i> ” unknown from Hell Creek fauna]
na	<i>Obovaria? pyramidella</i> (Whitfield)
<i>Unio</i> undescribed 1 fide Stanton †	<i>Plethobasus aesopiformis</i> (Whitfield)
na	<i>Plethobasus biesopoides</i> (Whitfield)
<i>Unio brachyopisthus</i> White	[Not identified by LSR †; present in Hell Creek fauna]
<i>Unio couesi</i> White [likely comparison]	<i>Plesielliptio gibbosoides</i> (Whitfield)
<i>Unio danae</i> Meek and Hayden (similar)	<i>Plesielliptio postbiplicatus</i> (Whitfield)
<i>Unio</i> undescribed 2 fide Stanton †	<i>Plesielliptio whitfieldi</i> Russell
<i>Unio brachyopithus</i> White	Present; not reported by Russell
na	<i>Proparreysia barnumi</i> (Pilsbry)
<i>Unio</i> undescribed 3 fide Stanton †	<i>Proparreysia corbiculoides</i> (Whitfield)
<i>Unio proavitus</i> White (similar)	<i>Pleurobema cryptorhynchus</i> (White)
<i>Unio holmesiana</i>	<i>Proparreysia holmesiana</i> (White)
<i>Unio</i> undescribed 4 fide Stanton †	<i>Proparreysia letsoni</i> (Whitfield)
na	<i>Proparreysia paucinodosa</i> Russell
<i>Unio</i> undescribed 5 fide Stanton †	<i>Proparreysia percorrugata</i> (Whitfield)
<i>Unio</i> undescribed 6 fide Stanton †	<i>Proparreysia pyramidatooides</i> (Whitfield)
na	<i>Proparreysia retusoides</i> (Whitfield)
<i>Unio</i> undescribed 7 fide Stanton †	<i>Proparreysia verrucosiformis</i> (Whitfield)
na	<i>Quadrula cylindricoides</i> (Whitfield)
<i>Unio proavitus</i> White [similar, †]	<i>Rhabdotophorus aldrichi</i> (White)
<i>Sphaerium planum</i> Meek and Hayden	<i>Sphaerium beckmani</i> Russell
<i>Sphaerium</i> sp.	[Other sphaeriids occur in Hell Creek fauna]
<i>Goniobasis tenuicarinata</i> (Meek and Hayden)	[Not reviewed by LSR; present in Hell Creek fauna]
<i>Lioplacodes limnaeiformis</i> (Meek and Hayden)	[Not reviewed by LSR; present in Hell Creek fauna]
<i>Campeloma multilineata</i> (Meek and Hayden)	[Not reviewed by LSR; present in Hell Creek fauna]
<i>Campeloma producta</i> White	[Not reviewed by LSR; similar form in Hell Creek fauna]
<i>Viviparus trochiformis</i> (Meek and Hayden)	[Not reviewed by LSR; similar form in Hell Creek fauna]
<i>Tulotoma thompsoni</i> White	[Not reviewed by LSR; present in Hell Creek fauna]
<i>Physa copei canadensis</i> Whiteaves	[Not reviewed by LSR; similar form in Hell Creek fauna]
<i>Limnaea</i> sp.	[Not reviewed by LSR; unknown affinity]
<i>Helix vetusta</i> Meek and Hayden	[Not reviewed by LSR; unknown affinity]

* Spellings of names of taxa follow Stanton and Knowlton (1897) and Russell (1976).

The Lancian age referenced to the Hell Creek Formation fauna is given by the authors.

† Notations in brackets observations by Hartman; see also Hartman (1998). LSR = L.S. Russell.

**TABLE DR4. RUSSELL's INTERPRETATION OF THE LANCIAN
HELL CREEK AGE AND FAUNA**

Lancian Hell Creek taxa (Russell, 1964)*	Hell Creek Formation taxa (Russell, 1976) †
<i>Corbicula subelliptica</i>	<i>Corbicula</i> cf. <i>C. subelliptica</i> (Meek and Hayden)
<i>Fusconaia? danae</i> (Meek and Hayden)	Discussed
<i>Fusconaia? gibbosoides</i>	<i>Plesielliptio gibbosoides</i> (Whitfield)
na	<i>Obovaria? pyramidella</i> (Whitfield)
<i>Plethobasis aesopiformis</i>	<i>Plethobasus aesopiformis</i> (Whitfield)
na	<i>Plethobasus biesopoides</i> (Whitfield)
na	<i>Plesielliptio postbiplicatus</i> (Whitfield)
na	<i>Plesielliptio whitfieldi</i> Russell
<i>Pleurobema? cryptorhynchus</i>	<i>Pleurobema cryptorhynchus</i> (White)
<i>Proparreysia barnumi</i>	<i>Proparreysia barnumi</i> (Pilsbry)
na	<i>Proparreysia corbiculoides</i> (Whitfield)
na	<i>Proparreysia paucinodosa</i> Russell
<i>Proparreysia holmesiana</i>	<i>Proparreysia holmesiana</i> (White)
<i>Proparreysia percorrugata</i>	<i>Proparreysia percorrugata</i> (Whitfield)
<i>Proparreysia pyramidatooides</i>	<i>Proparreysia pyramidatooides</i> (Whitfield)
<i>Proparreysia retusoides</i>	<i>Proparreysia retusoides</i> (Whitfield)
<i>Proparreysia verrucosiformis</i>	<i>Proparreysia verrucosiformis</i> (Whitfield)
<i>Proparreysia? letsoni</i>	<i>Proparreysia letsoni</i> (Whitfield)
<i>Quadrula cylindricoides</i>	<i>Quadrula cylindricoides</i> (Whitfield)
<i>Rhabdotophorus aldrichi</i>	<i>Rhabdotophorus aldrichi</i> (White)
<i>Sphaerium planum</i> Meek and Hayden	<i>Sphaerium beckmani</i> Russell
<i>Lioplacodes limnaeiformis</i> (Meek and Hayden)	na
<i>Physa rhomboidea</i> (Meek and Hayden)	na
<i>Viviparus plicappressus</i> White	na

* Spelling of taxa after Russell (1964).

† Spelling of taxa after Russell (1976).